Fig. 1

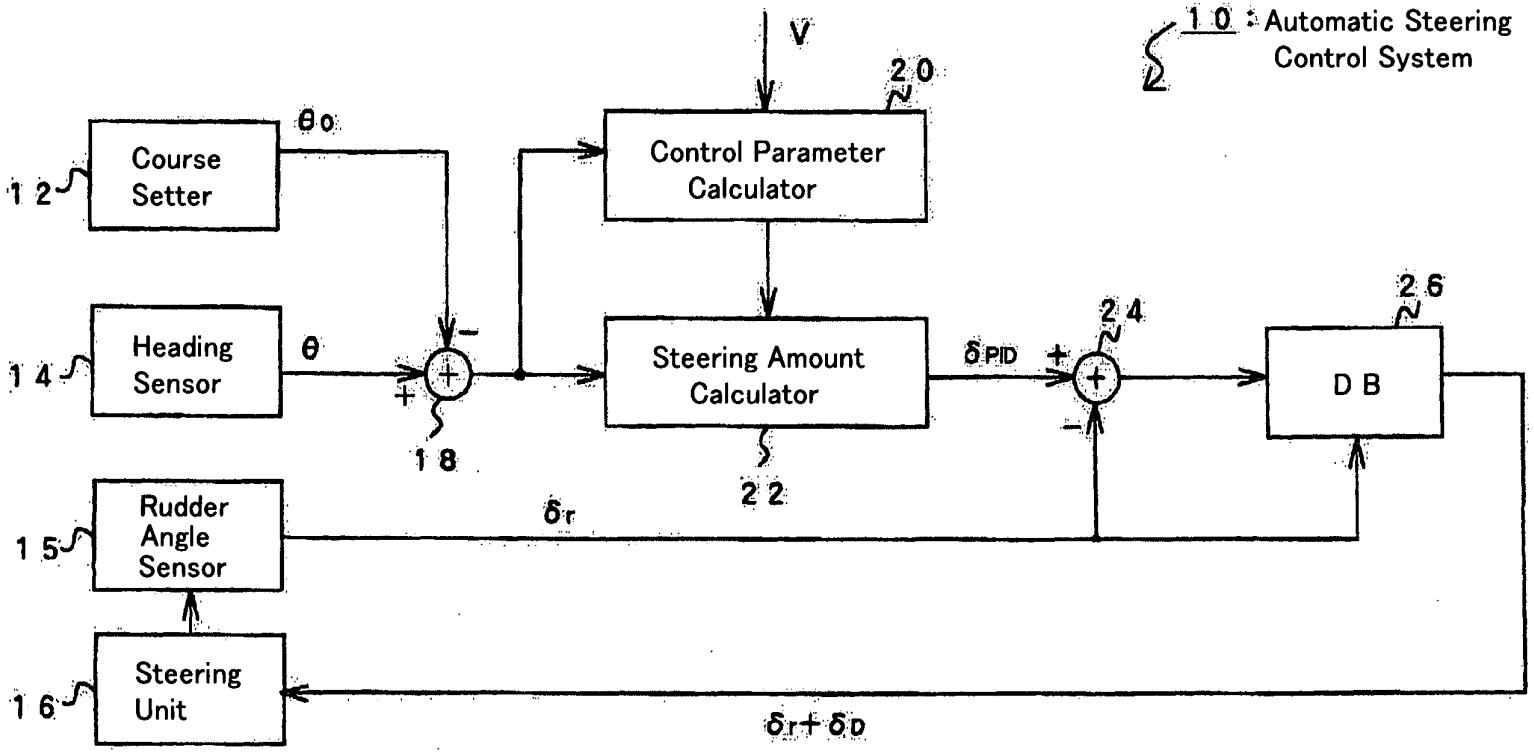
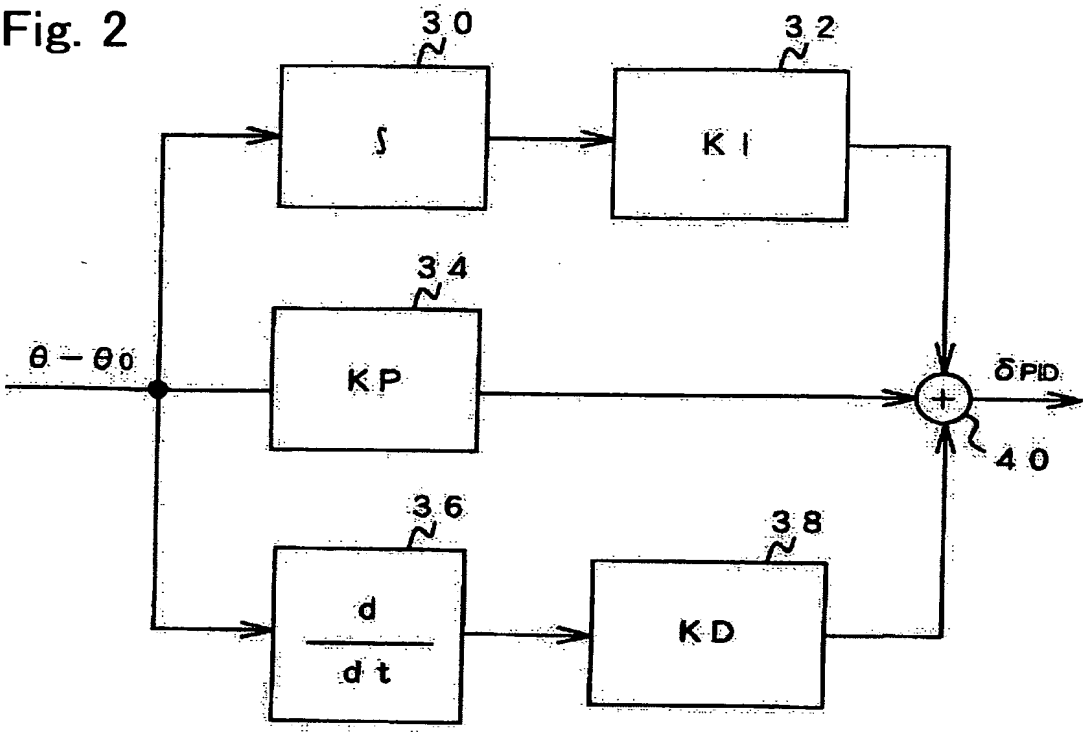

10 : Automatic Steering Control System
V
20
Control Parameter Calculator
θo
12
Course Setter
14
Heading Sensor
θ
18
22
Steering Amount Calculator
δPID
24
26
D B
15
Rudder Angle Sensor
δr
16
Steering Unit
δr+δD

Fig. 2



22 : Steeringt Amount Calculator

Fig. 3

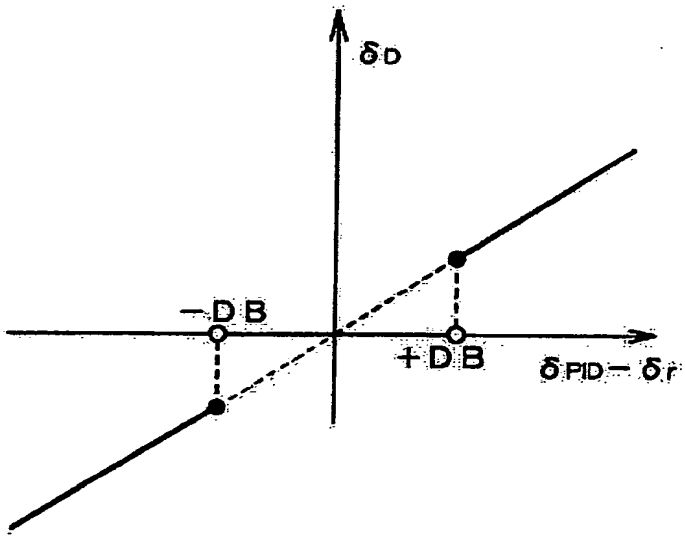


Fig. 4

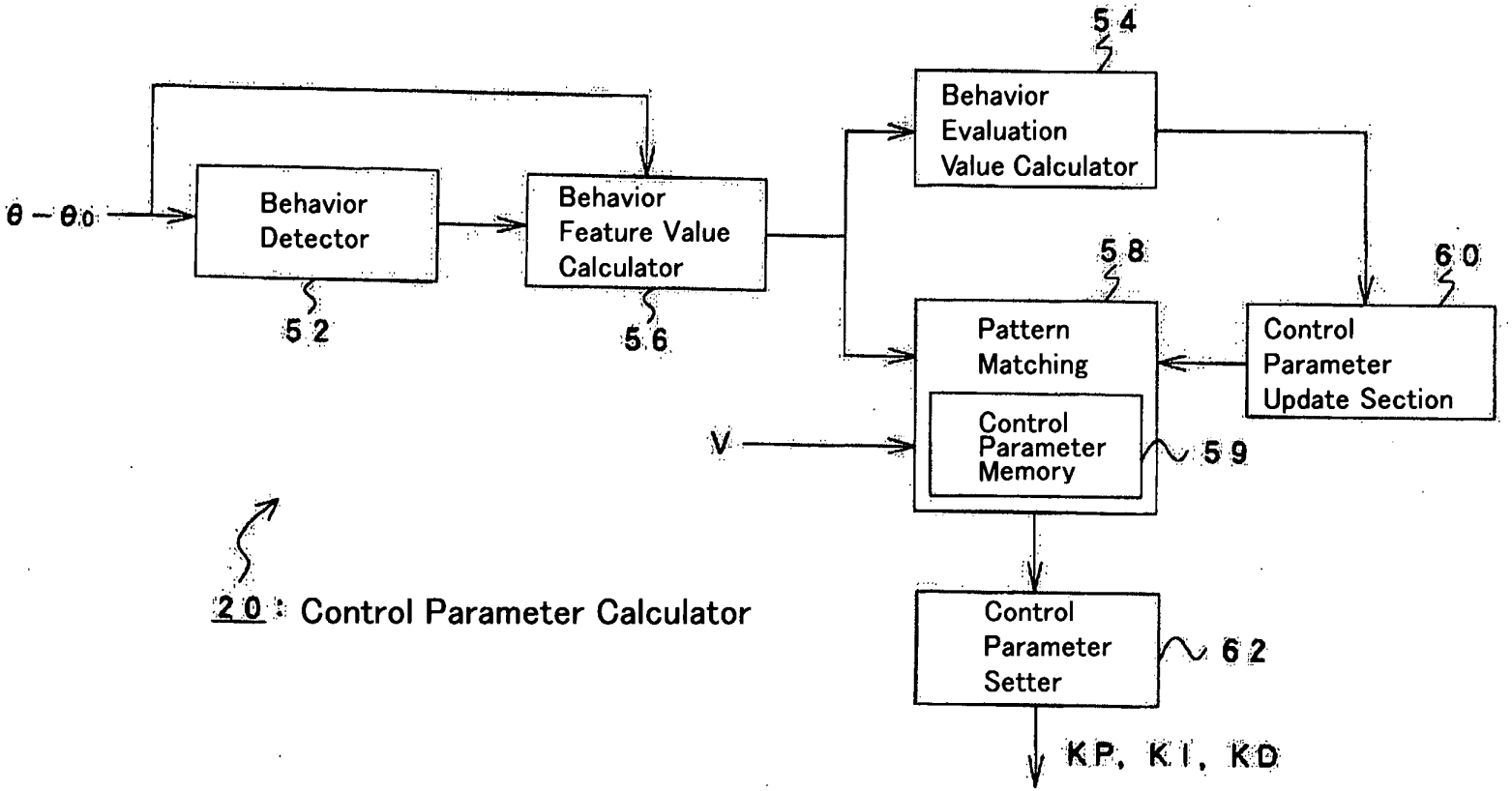
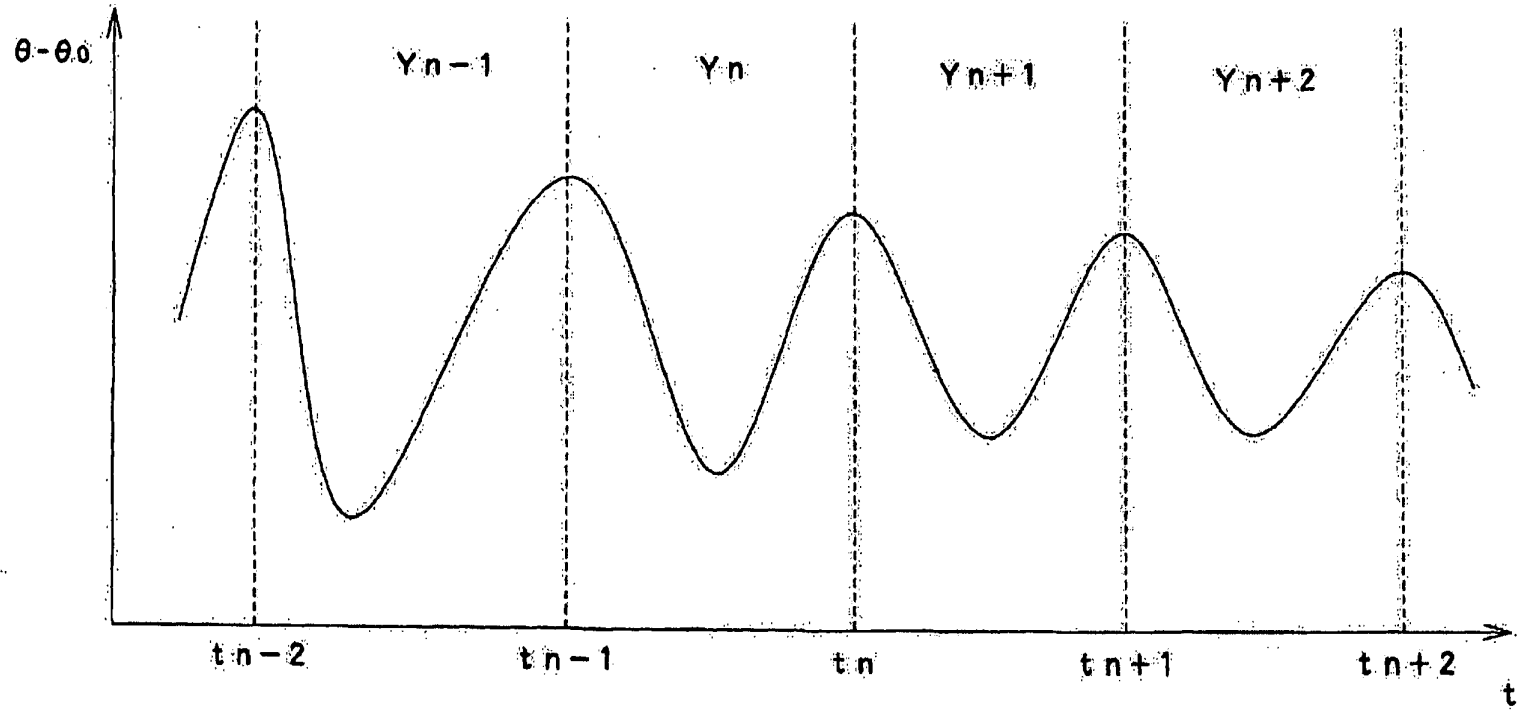

θ − θ0
Behavior Detector
52
Behavior Feature Value Calculator
56
54
Behavior Evaluation Value Calculator
58
Pattern Matching
Control Parameter Memory
59
60
Control Parameter Update Section
V
20 : Control Parameter Calculator
Control Parameter Setter
62
KP, KI, KD

Fig. 5



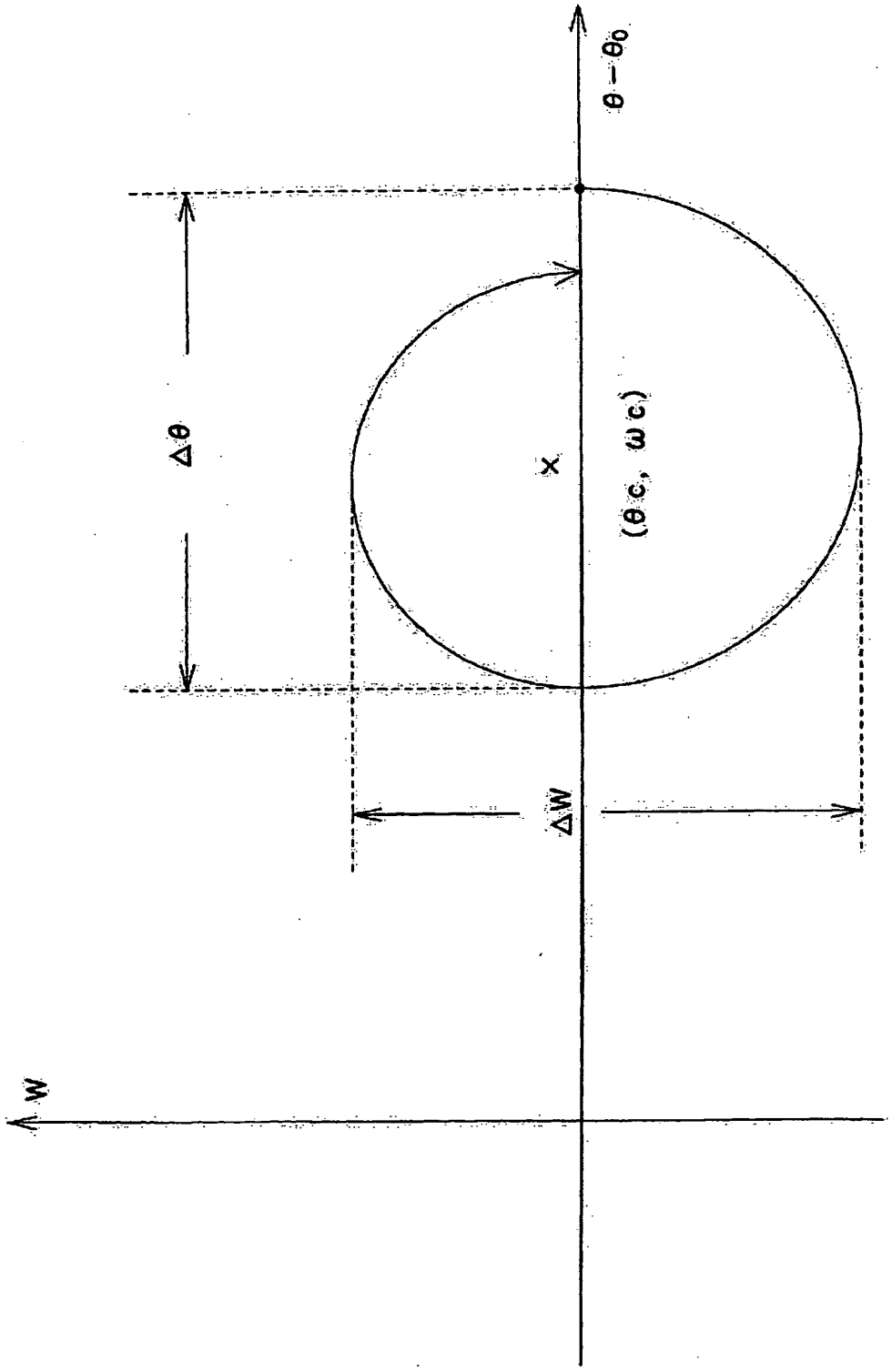


Fig. 6

Fig. 7a

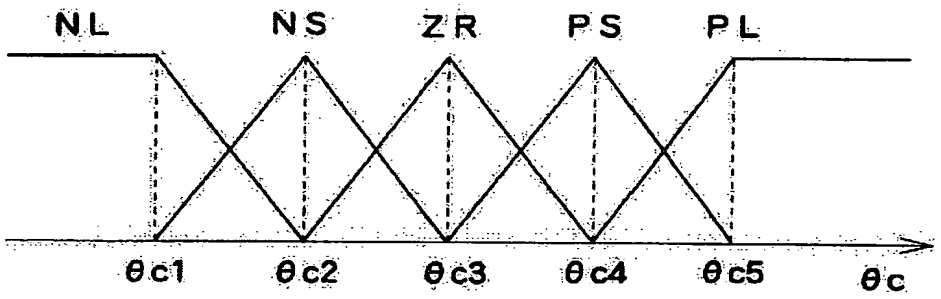


Fig. 7b

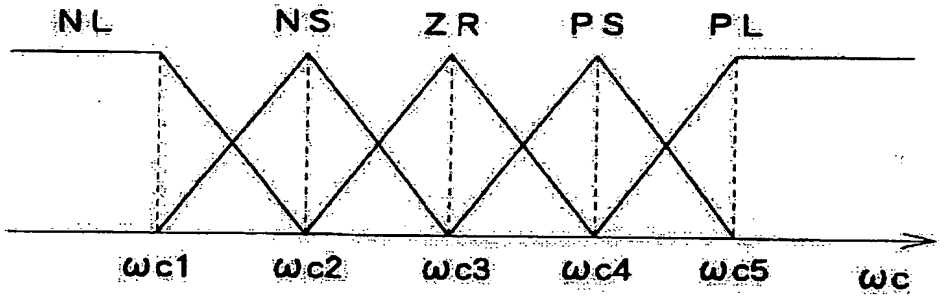


Fig. 7c

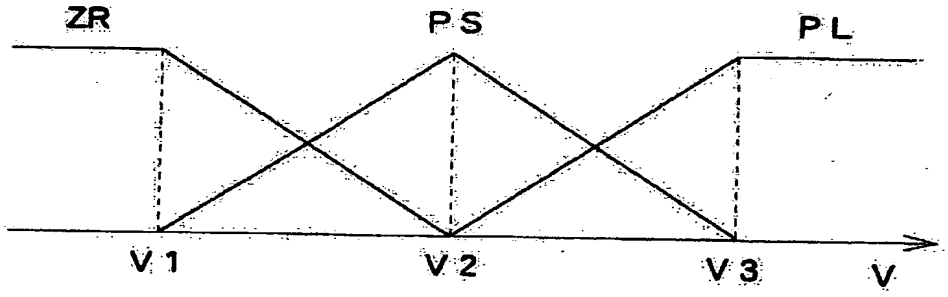
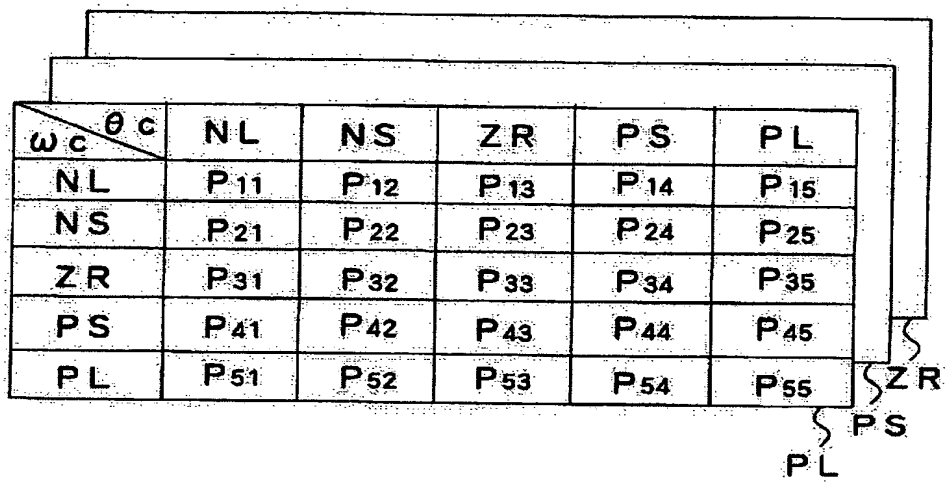


Fig. 8



ω_c \ θ_c	NL	NS	ZR	PS	PL
NL	P_{11}	P_{12}	P_{13}	P_{14}	P_{15}
NS	P_{21}	P_{22}	P_{23}	P_{24}	P_{25}
ZR	P_{31}	P_{32}	P_{33}	P_{34}	P_{35}
PS	P_{41}	P_{42}	P_{43}	P_{44}	P_{45}
PL	P_{51}	P_{52}	P_{53}	P_{54}	P_{55}

Fig. 9

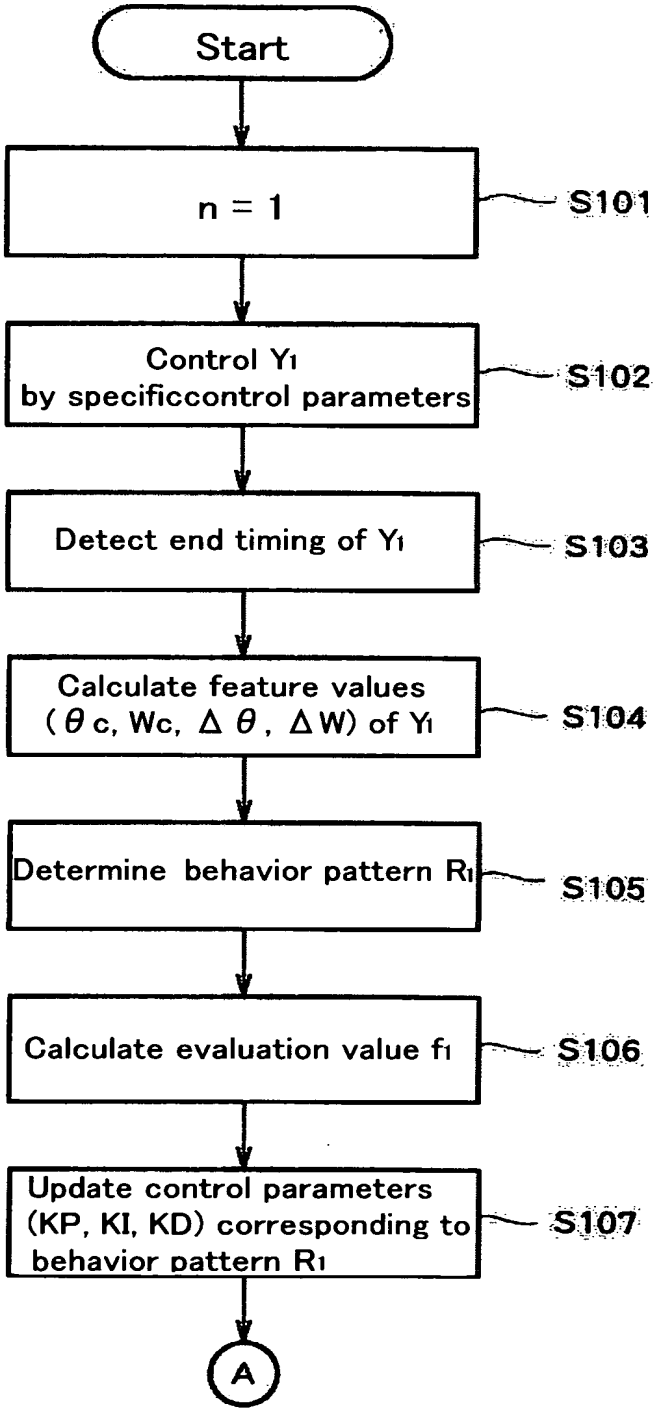
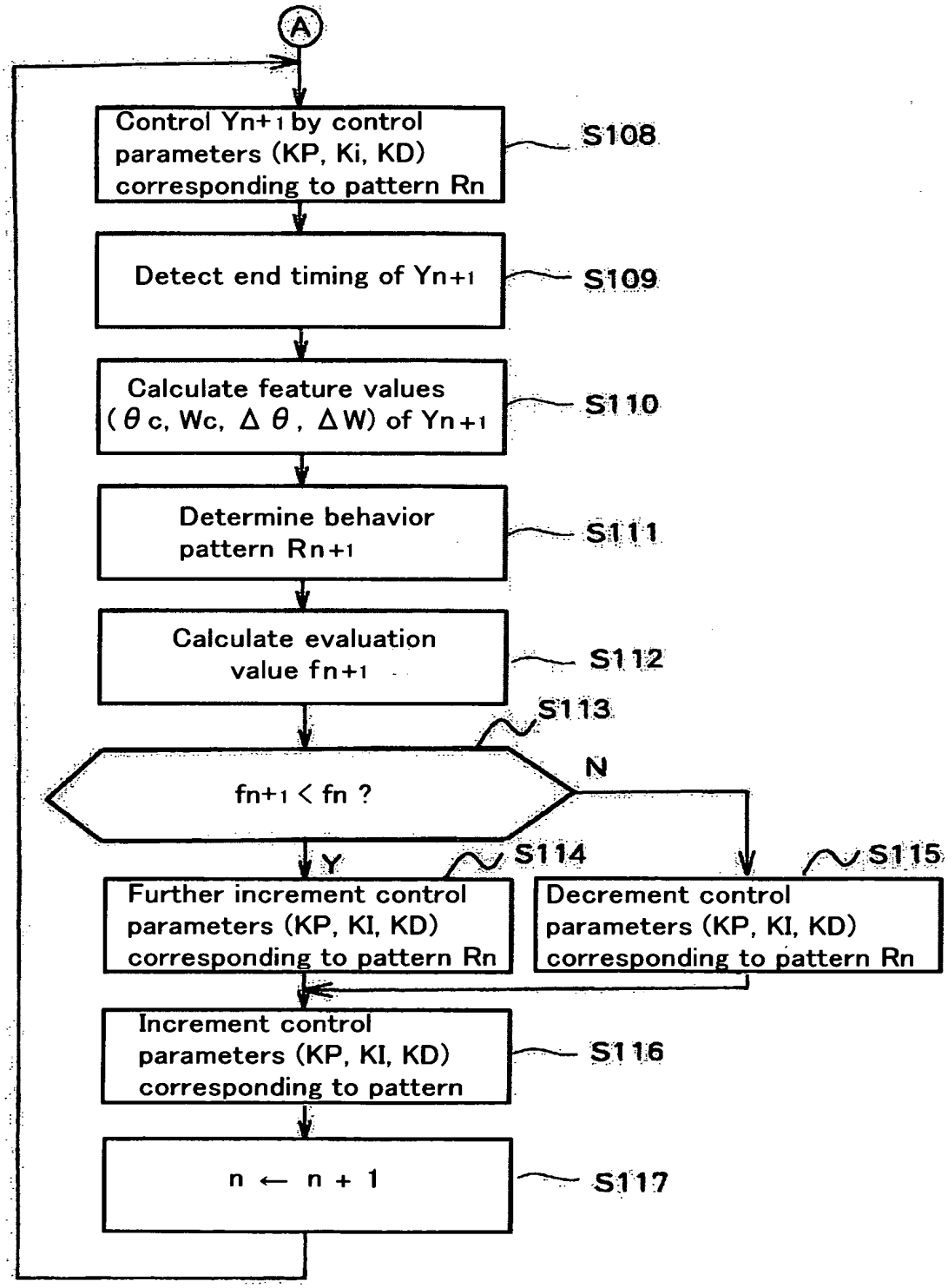

Start
n = 1
S101
Control Yi
by specificcontrol parameters
S102
Detect end timing of Yi
S103
Calculate feature values
(θc, Wc, Δθ, ΔW) of Yi
S104
Determine behavior pattern Ri
S105
Calculate evaluation value fi
S106
Update control parameters
(KP, KI, KD) corresponding to
behavior pattern Ri
S107
A

Fig. 10


A
Control Yn+1 by control parameters (KP, Ki, KD) corresponding to pattern Rn
S108
Detect end timing of Yn+1
S109
Calculate feature values (θc, Wc, Δθ, ΔW) of Yn+1
S110
Determine behavior pattern Rn+1
S111
Calculate evaluation value fn+1
S112
S113
fn+1 < fn ?
N
Y
S114
Further increment control parameters (KP, KI, KD) corresponding to pattern Rn
S115
Decrement control parameters (KP, KI, KD) corresponding to pattern Rn
Increment control parameters (KP, KI, KD) corresponding to pattern
S116
n ← n + 1
S117